

## AIRSHIP TECHNOLOGY

### *Second Edition*

This comprehensive guide to modern airship design and operation, written by world experts, is the only up-to-date book on airship technology intended as a technical guide to those interested in studying, designing, building, flying, and operating airships. In addition to basic airship principles, the book covers conventional and unconventional design in a panoramic, in-depth manner, focusing on four themes: (1) basic principles, such as aerostatics, aerodynamics, propulsion, materials and structures, stability and control, mooring and ground handling, and piloting and meteorology; (2) different airship types, including conventional (manned and unmanned), hot air, solar powered, and hybrid; (3) airship applications, including surveillance, tourism, heavy lift, and disaster and humanitarian relief; and (4) airship roles and economic considerations. This second edition introduces nine new chapters and includes significant revisions and updates to five of the original chapters.

Gabriel Alexander Khoury (DIC, CEng, EurIng, FIStructE, MNucl, MIFE, FRAeS) is a Professor of Engineering at Imperial College of Science, Technology and Medicine, London, and Padua University, Italy. His interests include airships in general and solar-powered airships in particular, for which he first published the proof in 1978. He was elected Member of the Technical Committee of The Airship Association in 1979, Council Member in 1990, and Vice Chairman in 2011. Khoury organized several international conferences of The Airship Association in Bedford, Cambridge, Friedrichshafen, and most recently Paris. For his contributions to airships, Khoury was elected a Fellow of the Royal Aeronautical Society. He was a founding member of the British Solar Energy Society and was also elected Scientific Manager of three European-funded multinational projects related to safety and Chairman of an international committee on fire safety design. In 2009, he was awarded an international prize for best paper by the Institution of Civil Engineers. Khoury is also a Chartered Engineer, a Euro Engineer, Fellow of the Institution of Structural Engineers, Member of the Nuclear Institute, Member of the Institution of Fire Engineers, Director of Fire Safety Design, and Chief Executive of London Greenways.

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***The Volunteers of The Airship Association***

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# Airship Technology

*Second Edition*

**Gabriel Alexander Khoury**

Imperial College of Science, Technology  
and Medicine, London  
Padua University, Italy  
Vice Chairman, The Airship Association  
Fellow, Royal Aeronautical Society



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## Preface

This is the second edition of the book *Airship Technology*, first published by Cambridge University Press in 1999. It is a major improvement over the first edition, with the introduction of nine new chapters and the significant revision and updating of five of the original chapters.

This book covers the *basic scientific/engineering principles* of airships, which was the main subject of the first edition. In this category I have now added chapters on meteorology and ground handling. A new contribution for this edition is the *type of airships*, as these are varied: conventional ellipsoidal airships (e.g., Zeppelin New Technology [NT]), hybrid tri-lobed lifting body airships (e.g., hybrid air vehicles), unmanned airships, hot air airships, and human-powered airships. Airship roles are important, hence the introduction in the new chapters of information on airship *applications*, such as geological surveys, communications, passenger services, media, surveillance, and advertising. Examples of these are chapters on heavy lift and disaster and humanitarian relief. Since the first edition, the design of ‘unconventional’ hybrid airships has advanced significantly, especially in the dynastat tri-lobe lifting body form (see Chapters 19 and 26; an example is the hybrid air vehicle), while the design of ‘conventional’ airships has reached new technical and operational advancement with the Zeppelin NT series (Chapter 21). It was recognised in the first edition that the airship pilot (see Chapter 14 on piloting) almost needs to become a part-time meteorologist. Thus, a new chapter dedicated to meteorology has been introduced (Chapter 13), as is a new chapter dedicated solely to the important issue of ground handling, for which many lessons need to be learned from past experience (Chapter 12). The chapters on materials and unconventional designs (Chapters 6 and 19, respectively) have been significantly revised and updated. There have also been increased interest and activity in relatively low-cost unmanned airships for low-altitude (and high-altitude) applications (Chapters 19 and 22), in which the human element is taken out of the direct loop. Given the inherent lifting capacity of airships (at least the structure), there has been, for nearly half a century, an interest in their use for heavy lift applications such as logging and civil engineering. A new chapter on heavy lift brings together some of the designs, whether by means of the aerostat, dynastat, or rotastat airship options (Chapter 25). Interestingly, work on rotating hulls from various teams (part of Chapter 19) has declined since the first edition, but this is still covered here.

Pioneering attempts have been made to cross the English Channel by piloted airships powered solely by human power representing human endeavour (Chapter 24) and in the future possibly by solar power to demonstrate the capability of this form of ‘renewable fuel’ (in Chapter 19). Both are also described in this new edition. Hot air airships are popular for sport (also for aerial advertising and environmental research); this subject is covered in this edition by a leading expert (Chapter 23).

This book provides a panoramic view of airship technology and design with its varying and fascinating options, but necessarily starting with the basic principles of aerostatics (Chapter 8), aerodynamics (Chapter 3), stability and control (Chapter 4), propulsion (Chapter 5), materials (Chapter 6), structures (Chapter 7), weight estimates and controls (Chapter 9), systems (Chapter 10), design synthesis (Chapter 17), mooring (Chapter 11), and solar power (Chapter 20).

The impetus for the first edition was the lack of a post–World War II modern technical book on airship design and technology, coupled with the revival of serious interest in airships by both industrialists and academics that had taken place since the early 1970s with the formation of The Airship Association and with the publication of its journal, *Airship*; its annual symposia; its international conventions and exhibitions; and its dedicated website (<http://www.airship-association.org>). This second edition of *Airship Technology* takes the subject into the twenty-first century.

Whether in design and development, or merely in operation, airship activity has taken place in many countries around the world including the United Kingdom, Germany, France, Australia, Canada, China, Brazil, Mexico, India, Hungary, Italy, Japan, Mexico, New Zealand, Russia, South Africa, and the United States.

This book draws on recent experience by bringing together twenty-two specialists in different aspects of airship design and operation, from different parts of the world, in an integrated and holistic manner. These experts were drawn from both academia and industry, thus providing the appropriate balance of theory and practice.

Gabriel Alexander Khoury



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### Contributors

The editor wishes to express his appreciation to the other twenty-one authors of the different chapters for their valuable contributions and friendly, positive cooperation.

These are Dr Edwin Mowforth, Professor Ian Cheeseman, Mr Michael V. Cook, Dr Shafiu Islam, Mr Peter Bradley, Mr Charles Luffman, Mr John Craig, Mr Norman Mayer, Professor Denis Howe, Dr Giles Camplin, Mr Martin Harris, Mr David Burns, Mr Robert C. Hunt, Mr Brian G. Wilson, Mr Reginald Hillsdon, Dr Bernd Straeter, Mr Leon Eversfield, Mr Karl Ludwig Busemeyer, Mr Robert Knotts, Dr Ingolf Schaefer, and Mr Ken R. Nippress.

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The contribution of The Airship Association – direct and indirect – is also very much appreciated.

### Images

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